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AN INTERPRETATIVE ANALYSIS OF THE NATURAL GAS POLICY OF THE FEDERAL GOVERNMENT AS EXEMPLIFIED BY THE "PHILLIPS CASE"

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AN INTERPRETATIVE ANALYSIS OF THE NATURAL GAS POLICY OF THE FEDERAL GOVERNMENT AS EXEMPLIFIED BY THE "PHILLIPS CASE"

by

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B.S., United States Naval Academy, 1941

Submitted to the Graduate School of the University of Pittsburgh in partial fulfillment of the requirements for the degree of Master of Science

Pittsburgh, Pennsylvania

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I. FOREWORD

The Natural Gas Industry has from its beginning gained in importance to the American people with each passing year. As the public reliance on natural gas has increased the local, state, and Federal governments have increased regulation of the industry. Most of this regulation has been of such a nature as to insure the public of increased natural gas supplies at reasonable prices. Little if any thought has been given to the welfare of the industry. The crest of regulation against the industry has been reached with the Supreme Court's decision in the "Phillips Case." If this interpretation is allowed to stand then there is strong reason to believe that the Natural Gas Industry has reached its zenith and must now start a decline under the burden of strangling regulation. Consequently, instead of increasing gas supplies at reasonable prices the increased regulation will in all probability cause a decrease in natural gas supplies and an increase in price.

It is the purpose of this paper to show how the regulation of the Natural Gas Industry has grown to such proportions that it no longer serves the purpose intended, but rather it is destroying the very things it was created to preserve. By looking at the possible results of the Phillips Case on the Gas Industry, certain plausible conclusions and predictions can be made for the future of the industry. Possible solutions to the dilemma of over-regulation are presented in the hopes that future moves to regulate can be forestalled. Then perhaps the present regulations can be reduced so that the industry can more adequately serve the public and at the same time strengthen and preserve itself.

I. REGULATORY POWERS OF THE FEDERAL GOVERNMENT

A. Laissez Faire

From the very beginning of this country, the people of the United States have, in general, believed in a system of free enterprise with a minimum of interference in private business by the government. Under this philosophy the government should serve the individual and not interfer with his freedom except to protect the equal freedom of others. This philosophy of individual freedom in economic pursuits is best expressed in the doctrine of "laissez faire." According to this doctrine the individual should be allowed maximum freedom of action in the process of making a living. Governmental interference with the individual's activities should be limited to the extent necessary to prevent force and fraud.[1]

Under the laissez faire philosophy of economic conduct, it is felt that business should be conducted by private individuals and not by the government. Private ownership and operation of business is much more efficient and economical than is government ownership or operation. When an individual produces these things which the public wants to buy and for which they give him the greatest profits, he is working for both the public and his own best interests. The individual businessman, unhampered by governmental restrictions, must promote maximum efficiency in his organization in order to meet the competition from other free competitors. This type of free competition protects the public from exploitation and guarantees the best possible goods at the lowest possible prices.[2]

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[1]References listed in the Bibliography

[illegible] signed in the negotiations

B. Duties of the Government

The government's role in our system of free enterprise is that of protection, aid, and service. It must protect the property rights of the individual so that the individual may have access to his property for his own enterprises. In order to insure fair competition, the government must protect society against the growth of monopoly. A sound monetary system must be provided to aid business. The government must aid and serve society by providing services, which by their very nature, cannot be provided by private enterprise at a profit---schools, parks, and Armed Forces, to mention a few examples.[2]

Starting in the nineteenth century a certain minimum of governmental interference with private business came to be accepted as necessary and desirable. In certain industries this interference has grown to considerable proportions. It is not unnatural that the body of law built up by court decisions continues to be applied to those industries which fall into the category of transportation, public utilities, banks, insurance companies and the like. These interferences in the afore mentioned industries have now come to be considered governmental prerogatives. As such, the government is now expected to provide these services either directly or by delegation of their performance to private companies. Under this condition the private company is deemed to be acting as an agent of the government and is thus subject to its control. This point of view was expounded in an 1837 judicial opinion concerning the railroads in which the Supreme Court said in part:

> That railroads, though constructed by private corporations and owned by them, are public highways, has been the doctrine of nearly all the courts ever since such conviences for passage and transporatation have had any existence....

> Whether the use of a railroad is a public or private one depends in no measure upon the question who constructed it or who owns it. It has never been considered a matter of any importance that the road was built by the agency of a private corporation. No matter who is the agent, the function performed is that of the State. Though the ownership is private the use is public.[3]

The government's regulation of rail transportation under this agency principle is not to be denied, but should this principle be equally applied to the gas industry? The distribution and sale of gas has of late been considered a proper area of government regulation, yet the provision of fuel has never been regarded as a peculiar function of the government. Gas, electricity, coal and wood are all used for heating and cooking, yet only the distribution and sale of gas and electricity are under strict regulation. The best explanation of this discrepancy is that the distribution and sale of gas and electricity fall into the category of monopoly in a field of great public interest.[4]

C. Justification for Governmental Regulation

The general public has two sources to protect it from business exploitation such as high prices, poor or discriminatory service, and arbitrary rules and regulations. These two sources are government regulation and free competition. Under free competition businessmen compete with one another for public patronage, either by cutting prices, by providing a product of higher quality, or by giving superior service. Thus by free competition the public is assured of the manufacture and sale of the highest quality products at the lowest possible prices and with the best service possible.[5]

It is at times impossible or impractical to have competition. The construction of municipal gas storages and the building of the transmission system require a considerable investment on the part of a gas distribution company. The company must have all the business it can get if it is to be a profitable venture. The rise of a competitor in this area might well mean that neither could survive the competition and the community served would thus be deprived of the very commodity both companies were trying to deliver. Obviously if the public is to be adequately served the service company must be protected from competition---that is to say, it must be permitted to flourish as a monopoly. The public is no longer protected by competition, therefore, "regulation is justified when a monopolistic situation exists in a business involving great public interest".[5]

D. Basis for Federal Government Regulation

Today practically all regulation in this country is carried on under the provisions of statues enacted by various legislative bodies. Statutory law regulation takes precedence over common law regulation. Common law may be applied to any situation not covered by statute law. Legislatures must act within the frame work of the state and national constitutions. Thus the Federal Government may engage only in those activities delegated to it by the Constitution of the United States.[6] The only specific authority that Congress has to regulate business is found in the commerce clause of the Constitution which gives it the right "to regulate commerce with foreign nations, among the several States, and with the Indian tribes".[7] Thus Federal legislation is limited to the regulation of interstate and international commerce.

A state's legislative activity is restricted by certain provisions of the Federal Constitution. There is, however, a broad area for the regulation of business by the states, even after making allowances for the limitations of state sovereignty. In this area the state may legislate and regulate to control the use of liberty and property. This is done for the purpose of protecting public health, safety, morals, and general welfare. It is through these powers that the state can determine the proper measures for the conservation of natural resources and the proper price of utilities.[8]

II. PIPELINE TRANSPORTATION

A. Development of Pipeline Transportation

The Petroleum industry was under no restriction or regulation whatsoever at its inception. As it grew in importance and the public came more and more to depend upon it, controls and regulations were gradually applied. In 1859 near Titusville, Pennsylvania, Colonel E. L. Drake drilled the first well for the purpose of producing oil. In a very short time the entire country about Titusville was in an uproar over this new source of wealth. Well after well was drilled and brought into production. Since most of the wells were located in remote areas, transportation of the oil became an immediate problem. At first teamsters were employed to haul the oil to the nearest railroad. The loads carried were small, the teamster's wages high and the roads used were unreliable. Early in 1860 attempts were made to move oil by pipeline, but the teamsters seeing an infringement on their lucrative trade, ripped up the pipelines and smashed the pumps during the night. Eventually as production increased, the construction and expansion of the pipelines outran the attempts to destroy them.[9]

While the petroleum industry was making great strides after 1859, the natural gas industry was barely starting. In the Titusville area the gas produced with the oil was considered as a nuisance and its disposal was a problem. The gas had no saleable value and constituted a fire hazard around the well. It killed vegetation and animal life and made the surrounding area untenable. It was not until 1872 that the first large scale commercial venture with natural gas was successful. The unwanted nuisance was piped to nearby communities for household consumption, thereby marking the beginning of the natural gas industry in this country.[10]

B. Demand for the Regulation of Pipeline Transportation

By 1872 the place of the pipeline in the petroleum industry was assured. At this time three companies dominated the field; the Pennsylvania Transportation Company, the Pennsylvania Railroad's Empire Transportation Company, and the United Pipe Lines. John D. Rockefeller, who up until this time, was primarily concerned with oil refining facilities, decided to obtain an interest in the United Pipe Lines. Rockefeller pursued his interest in pipelines until in 1883 he gained control of the Tidewater Pipe Line Company. From here on until the early 1900's Rockefeller continued to build a nearly complete monopoly of the petroleum industry. In 1906, under President Theodore Roosevelt, Congress passed the Hepburn Act which destroyed the Rockefeller monopoly by placing interstate pipelines under control of the Interstate Commerce Commission. This was the first step in Federal Regulation of the petroleum industry.[11]

III. REGULATION OF NATURAL GAS PIPE LINES

A. The Natural Gas Act of 1938

When oil carrying pipelines came under Federal regulation in 1906, the natural gas pipelines were specifically excluded. But from that time on there was considerable agitation for the regulation of natural gas pipelines. State public utility commissions and municipalities had controlled the sale of natural gas to consumers for many years, but it was not until 1938 that the Federal government finally started to regulate the transportation and sale of gas moved in interstate pipelines.[12]

The necessity for regulation and the scope of such regulation is set forth in the Natural Gas Act itself:[13]

> Section 1. (a) As disclosed in reports of the Federal Trade Commission made pursuant to Senate Resolution 83 (Seventieth Congress, first session) and other reports declared that the business of transporting and selling natural gas for ultimate distribution to the public is affected with a public interest, and that Federal regulation in matters relating to the transportation of natural gas and the sale thereof in interstate and foreign commerce is necessary in the public interest.
>
> Section 1. (b) The provisions of this act shall apply to the transportation of natural gas in interstate commerce, to the sale in interstate commerce of natural gas for resale for ultimate public consumption for domestic, commercial, industrial, or any other use, and to natural-gas companies engaged in such transportation or sale, but shall not apply to any other transportation or sale of natural gas or to the local distribution of natural gas or to the facilities used for such distribution or to the production or gathering of natural gas. (52 Stat. 821 (1938); 15 U.S.C. 717 (1946)

It is interesting that because of initial Federal regulation, the two fuels so closely associated in nature and again in transportation are regulated by the different government agencies. Oil pipelines are regulated by the Interstate Commerce Commission, since that agency was already active

in 1906 when Congress started their regulation under the Hepburn Act. In 1938, when the natural gas pipelines came under federal regulation, the Federal Power Commission had been active in the field of public utility control for eighteen years.[14] The mere fact that the Natural Gas industry is associated with the Federal Power Commission automatically directs thinking in terms of public utilities. This commission from its very beginning has been involved not only with the transportation of utility power, but also its original development and its sale to local municipalities. It would appear that had the natural gas pipeline been placed under regulation at the same time as its natural brother---the oil pipeline, the Interstate Commerce Commission would be regulating it for what it really is---a system of interstate transportation and not a utility from start to finish.

B. The Federal Power Commission

The Federal Power Commission is made up of five men appointed by the President, subject to confirmation by the Senate. The term of office is for five years with one term expiring each June 22. The chairman of this group is chosen by the President and it is he who is responsible for the executive and administrative authority of the Commission. The members of the Commission annually elect a vice chairman.[14]

In carrying out its duties of regulating, investigating, licensing and so forth, the Commission is augmented by a large staff of permanent federal civil service employees. Thus while the Commission itself may undergo changes every year, its staff may not change for years. Since the staff has been associated with the work for a considerable period of time, and since it is not subject to constant change, it is understandable that it can and does exert a tremendous affect upon the thinking of the Commission. Before the Commission can make any radical changes it must first move the inertia within its own staff.[14, 15]

IV. THE PHILLIPS CASE

A. Events Leading Up to the Federal Power Commission Hearing

From the time of the original investigation leading up to the Natural Gas Act, it has been recognized that production was properly controlled in the field by the various states. The sale of natural gas to the consumer, on the other end, was well under control of the state public utility commission and the local municipalities. It was the opinion of the Federal Trade Commission in its report, that the only proper area of Federal Regulation was between these points of state control, namely, interstate transportation.[16] The report submitted by this body summed it up nicely when it said:

> So, broadly speaking, we have in natural gas a situation which no matter how fully and properly integrated, will present at both ends problems which are either of local concern, or which are of both local and general public concern, in between a field of interstate transportation where only through the exercise of Federal jurisdiction can proper solution be obtained.[17]

Section 1 paragraph (a) of the Natural Gas Act itself, showed that Congress was interested only in the transportation of natural gas in interstate and foreign commerce. Paragraph (b) of the same section specifically extended exemption to "any other transporatation or sale of natural gas or to the local distribution of natural gas or to the facilities used for such distribution or to the production or gathering of natural gas.".[18]

The Federal Power Commission has held hearings on the application of Section 1 of the Act to producers and gatherers nine times to date. In all of these hearings not once has it held that it does have authority over "independent" producers and gatherers making sales at "arm's length" for

resale into interstate commerce. The last of these cases involved the Phillips Petroleum Company.[19]

The Commission, while exempting "independent" producers and gatherers from its jurisdiction has ruled that it does have jurisdiction over the same operations of "natural gas companies" as defined by the Act. On this point the Commission has been upheld by the courts. To help clarify this area of confusion two bills were introduced into Congress---the Risley-Moore Bill in 1947 and the Kerr Bill in 1949. Of the two only the Kerr Bill was passed and it was then vetoed by President Harry S. Truman in 1950.[20]

At the time the Kerr Bill was vetoed, the Commission had investigated the Phillips Petroleum Company and had ordered hearings to be held. When the veto was made public, the State of Wisconsin and Public Service Commission of Wisconsin and the cities of Detroit, Michigan; Kansas City, Missouri; Milwaukee, Wisconsin, and the County of Wayne, Michigan, intervened in support of the Commission's jurisdiction over Phillips' sales. Opposing the Commission's jurisdiction were the States of Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma, and Texas.

B. Results of the Federal Power Commission's Hearing

As a result of these hearings the commission in a four to one decision held that the Phillips Petroleum Company was an independent producer and gatherer. The Commission in its ruling stated that it did not have authority over the Phillips Petroleum Company. It further said in the majority report that:

> In varying degrees, the evidence clearly shows that our regulation of sales made in the process of production and gathering would, by its very nature, be inconsistent or constitute a substantial interference with such regulation of producers and gatherers by Oklahoma, Texas, and New Mexico. To cite one example, there is a direct relation between price and conservation, an important concern in the regulation of each of the States.[22]

This case was next heard in the Court of Appeals for the District of Columbia Circuit. The court handed down its opinion on May 22, 1953. Its decision reversed that of the Federal Trade Commission. The Court's majority opinion is expressed as follows:

> . . . . Phillips' sales to the pipeline companies are not within either the statutory phrase 'the production or gathering of natural gas' or the Supreme Court's para-phrase 'made during the course of production and gathering'. Therefore Phillips is a 'natural-gas company' within the meaning of the Natural Gas Act and the Commission should fix the rates at which these sales are made.[23]

The next logical step in the Phillips Case was an appeal to the Supreme Court. The Supreme Court, however, on November 30, 1953, refused to hear the appeal.[24] In January of 1954 it reversed itself and decided that it would review the case.[25]

V. THE SUPREME COURT AND THE PHILLIPS CASE

On June 7, 1954, the Supreme Court ruled five to three that the Federal Power Commission should regulate the Phillips Petroleum Company's sales of natural gas to interstate pipeline companies.[26] In effect this gives the commission ratemaking power over 2,300 "independent"producers who sell their natural gas to interstate pipelines.[26] In writing the majority opinion in which he was joined by Chief Justice Warren and Justices Black, Reed, and Frankfurter, Justice Minton said:

> The legislative history indicates a congressional intent to give the commission jurisdiction over the rates of all wholesalers of natural gas in interstate commerce, whether by a pipeline company or not, and whether occurring before, during, or after transmission by an interstate pipeline company . . .
>
> Regulation of the sales in interstate commerce for resale made by a so-called independent natural gas producer is not essentially different from regulation of such sales when made by an affiliate of an interstate pipeline company. In both cases, the rates charged may have a direct and substantial effect on the price paid by the ultimate consumers. Protection of consumers against exploitation at the hands of natural gas companies was the primary aim of the Natural Gas Act. Attempts to weaken this protection by amendatory legislation exempting independent natural gas producers from Federal regulation have repeatedly failed, and we refuse to achieve the same result by a strained interpretation of the existing statutory language.[26]

Justice Jackson took no part in the case. Justices Clark, Burton, and Douglas dissented. Justice Clark in reference to the majority opinion said:

> On its face, this language brings every gas operator, from the smallest producer to the largest pipeline, under Federal regulatory control. In so doing, the court acts contrary to the intention of Congress, the understanding of the states, and that of the Federal Power Commission itself. The Federal Power Commission is thereby thrust into the regulatory domain traditionally reserved to the states.[26]

Two previous decisions by the Supreme Court gave adquate warning as

to what their decision would be in the Phillips Case. In the 1945 ruling in the Colorado Interstate Gas Company case, it held that the rate base set by the Federal Power Commission for rate making purposes should include the production and gathering properties of an affiliate of an interstate pipeline company.[27] Again in 1947 in the Interstate Natural Gas Company Case, the court ruled that sales made by the company at the well head or during or at the conclusion of gathering were sales in interstate commerce. From the language used by the Court in this case it appeared that the Federal Power Commission had jurisdiction over the sales of all producers of gas that would be sold into interstate commerce.[27]

VI. THE FUTURE OF THE NATURAL GAS INDUSTRY BASED UPON THE FEDERAL GOVERNMENT'S REGULATORY POLICY

Now that the Courts have seen fit to change the Natural Gas Act by making the interpretations never intended by Congress, thereby putting Federal regulation at the wellhead and surplanting free competition and the state conservation laws, what is the future of the natural gas industry?

The Federal Power Commission's Natural Gas Investigation in 1948 gives some idea as to the possible effects of the latest Supreme Court decision:

> It is appropriate to point out, however, that if the Federal Power Commission were to be authorized to fix the prices of arm's length sales of natural gas by producers and gatherers to pipe-line companies transporting it in interstate commerce, the result would be to establish Federal authority over a substantial part of all field and well prices for natural gas. Control of oil as well as gas would necessarily become involved,[28] since the production of these two resources is to a large extent interrelated. Also, if the Federal Government were to fix the prices on sales of natural gas by producers and gatherers, such actions would impinge upon the functions of the States relative to oil and gas conservation and the protection of correlative property rights of producers in those resources.[29]

Thus the Commission expected not only control of gas, but oil as well, to result from the regulatory powers that they have just received. Further the Commission expects to infringe upon state oil and gas conservation programs.

A. Gas Reserves

In a normal free economy the factors of supply and demand tend to counteract and balance each other. Today the natural gas industry is found in an unnatural situation---that of having its supply threatened and its demand fostered as a result of governmental regulation. The recent decision of the Supreme Court in the Phillips Case has driven a wedge between supply and demand when the scales were already tipped in favor of demand. Until recently the supply of natural gas was in balance with the demand primarily on the basis of incidental finds while searching for oil. Recent forecasts for the demand of gas in 1975 have put it at two and a half times the 1953 figure of 8.7 trillion cubic feet.[30, 31] In addition most of the reserves have already been committed to a particular customer thereby eliminating present reserves from the future demands of new customers.[30] The only solution to the lopsided demand situation picture was to spend time and considerable money for the primary search for new gas fields, in order to provide ample reserves for the future demand.

In 1938 the proved gas reserves of this country stood at 70 trillion cubic feet. The production for 1938 was 2.9 trillion cubic feet thus giving a ratio of reserve to annual production of 23.6. In this same year Congress passed the Natural Gas Act, thereby setting up a partial disparity between supply and demand. During the restrictions on both supply and demand in the years of World War II the ratio rose to 31.2 in 1946. From this point on the restrictions on demand were dropped and those on supply increased until in 1953 with reserves of 204.8 trillion and production of 9.5 trillion the ratio of reserves to production have declined to 21.5.[32]

The Supreme Court's decision of June 7, 1954, is going to eliminate the desire on the part of some producers to make their gas reserves available to interstate transmission. As early as 1948 when the Federal Power Commission first conceived the idea of investigating Phillips, certain of the large producers removed their gas holdings from the interstate market. Others had clauses written into their contracts to free themselves in the event of Federal regulation.[33]

The State of Texas, in 1953, had 105.7 trillion cubic feet out of the nation's 199.7 trillion cubic feet reserve. Of the total reserves only 69.2 trillion cubic feet were not associated with crude oil. It is almost certain that the associated reserves will no longer be available to interstate transmission out of fear that such sale might eventually lead to Federal regulation of the Crude Oil Industry.[34]

The immediate short range effect of the Phillips Case is that even in the face of an increasing demand for more natural gas, the supply available to satisfy such demand is going to be decreased. As a result of withholding gas from the interstate market and the continued search for oil the nation's gas reserves will increase, while the supply of gas available for the interstate market will decrease.

B. Natural Gas Prices

Since the Supreme Court's decision was made with the thought in mind of "protection of consumers against exploitation," it might be well to see just how much the "independents" were exploiting the consumers. In 1950, for example, Phillips was selling gas in the Texas Panhandle to the Michigan-Wisconsin Pipeline Company for eight and one tenth cents per thousand cubic feet. It was transported to Wisconsin and sold to local operators at the "citygate" for thirty-one and a half cents a thousand cubic feet. The gas was then distributed to the consumer in Madison for $1.67 per MFC, Milwaukee for $1.43 and Racine for $2.18 per MFC. It is a little hard to see how Phillips, by charging eight and one tenth cents in Texas, is exploiting the consumer in Racine. A reduction of one cent in the field price would be a decrease of about twelve per cent for Phillips, but only one half of one per cent for the consumer in Racine, provided of course, that the decrease was passed along to the customer.[35]

As the field price of natural gas goes down, the supply of gas in the reserves will decrease and the demand by the consumers will increase. With an increasing demand meeting a dwindling supply it is certainly obvious that the price of natural gas must be forced up. Faced with a diminishing supply the very states and communities that fostered the investigation of Phillips will be bidding against each other. Possibly the Federal Power Commission will then ration gas to the consumer and thus complete the full cycle of regulation.

C. Exploration for Natural Gas

As has been previously pointed out, the demand for natural gas has become so great in recent years that the industry has been forced to conduct exploration efforts for it instead of relying on the search for oil to accidently discover it. To engage in gas exploration is to take a calculated chance. In 1953 there were 10,675 "wildcats" drilled in order to find 2hh new gas fields, 97 new distillate fields and 1,080 new oil fields. Since 1925 the average depth per well has risen from 2900 feet, to 4006 feet in 1953. The average "finding" costs have more than kept pace with the average increase in depth. The average size of a new discovery has gone from 35 billion cubic feet to 31 billion cubic feet from 1947 to 1952. The average field price has risen from six cents per mcf in 1947 to eight and three tenths cents in 1953. Last year small companies and individual operators owned 76.9 per cent of the wells drilled. The large companies, all together twenty-three, owned but 23.1 per cent of the 49,039 wells drilled.[36]

Since the "natural gas companies" are discouraged from owning their own reserves, the onus for finding and holding new pays is placed upon the shoulders of the small operator. As previously pointed out, the "wildcater" has about one chance in eight of hitting a new pay. The drilling costs are rising each year and the average depth of each well is increasing. The size of each new discovery is diminishing and now under Federal regulation the money received for each cubic foot of gas is at the best probably, going to be static and at the worst, decreased.

Thus the small operater's risk is increased as his prize is reduced. In addition, once he finds a new gas pay he must wait until his capital is

C. Organization for Research and Development

In addition to these activities, the Department is also charged with responsibility for research and development in the field of water resources. Such research is carried out in the Department's own laboratories, in the laboratories of other agencies, and in the laboratories of universities and private research organizations. The Department's research and development program is designed to provide the scientific knowledge and technological advances needed to support the Department's operating programs. The program is also designed to provide the scientific knowledge and technological advances needed to support the operating programs of other agencies and private organizations.

Since the Department's research and development program is designed to provide the scientific knowledge and technological advances needed to support the Department's operating programs, it is necessary that the research and development program be closely coordinated with the operating programs. The research and development program is also designed to provide the scientific knowledge and technological advances needed to support the operating programs of other agencies and private organizations. The research and development program is also designed to provide the scientific knowledge and technological advances needed to support the operating programs of other agencies and private organizations.

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returned in the form of depletion allowance and the present Federal Power Commission's profit rate of six per cent before he is free to begin another hazardous search.[37] In the light of these developments fewer small companies or operators can afford to "wildcat" and fewer will do so, with the net result of fewer new finds and thus a decrease in the nation's natural gas reserves.

D. Natural Gas Supply in Producing States

Faced with the choice of Federal regulation of interstate gas transmission the large producing states are most likely going to withhold their gas from interstate markets. In this way the threat of Federal regulation of crude oil can be overcome. Texas, which in 1953 held over fifty per cent of the national reserves, had nearly half of its production coming from oil wells.[38]

The restriction of gas to the producing state is going to throw supply out of balance with demand and thereby cause the price at the well head to drop. Gas which was heretofore too expensive for some uses will now become cheap. In areas with marginal operation, cheap gas will cause a shut in of wells, thus decreasing the states reserves. Waste will once again be rampant. The general result will be a decrease in the nation's gas reserves and less gas to the interstate consumer, at the same time the producing state will be glutted with gas at ridiculous prices.

E. Effects on the Petrochemical Industry

Natural gas in addition to being used commercially as a source of heat has recently become a raw product in the manufacture of many synthetic chemicals. Some of the new uses are found in the manufacture of synthetic rubber, ammonia, alcohols and other chemicals that are in wide demand in industry. Since these new petrochemical industries use other raw products along with natural gas they are not necessarily located in the immediate areas of gas production. These new industries are now placed in jeopardy due to the Federal regulation of the natural gas industry.[39]

These industries are now faced with the possible increase in price of one of their basic raw materials and a dwindling source of supply. The petrochemical industries must either go out of business or else move into the producing states. Of course the latter choice is the most logical, other factors remaining the same. Once again some of the far reaching effects of Federal regulation of the natural gas industry will be the migration of large industries to the greener pastures of the producing states where gas is plentiful and cheap. All of the northern industrial states will suffer, including the states that advocated Federal regulation.

F. Effects of Regulation on the Oil Industry

Natural gas has been considered a "premium" fuel for many years. It is much cleaner and easier handled than are its competitors---oil and coal. In addition, at the current prices it can heat the average home in some areas for only $90 per year against an approximate cost of $200 for oil, and $145 for coal.[40] It has grown tremendously in competition with oil and coal. In 1900 gas accounted for but 3.3 per cent of the mineral energy production of the United States, while coal accounted for 91.9 per cent and oil 4.8 per cent. In 1950 natural gas contributed 20.2 per cent to the total mineral energy of this country, while coal had dropped to 44.7 per cent and oil had risen to 35.1 per cent.[41] In this past year oil surplus has been built up to an alarming figure. The president of Standard Oil Company of California recently told the Texas Railroad Commission:

> . . . .it is apparent to us that the principal reason for failure of U. S. crude oil to find larger markets is not increasing imports . . . the primary reason is increasing competition from natural gas and the liquids produced therefrom.[42]

Mr. Peterson went on to say that Texas natural gas producers now receive only about one-fifth as much for their fuel as do oil producers when compared on a heat value basis. Further he said that natural gas selling in the field for ten cents a thousand cubic feet is like selling oil for sixty cents a barrel. Present gas prices are about ten cents per mcf and oil is selling at nearly three dollars per barrel. Then he went on to say that:

> This leads to the thought that royalties paid landowners are inordinately low and in no sense compensate them for the true value of natural gas being produced. Until such time as field prices for gas have come into closer balance with real values paid to producer of crude oil, property and royalty owners can continue to expect meager returns and crude oil will suffer still further inroads in its markets.[42]

If oil can avoid Federal regulation in the interestate market the results of such regulation of the natural gas industry should be an increase in the price and consumption of oil. Most large industries that are presently using natural gas for heating purposes have alternate systems whereby coal or oil can be used. Since gas may well be high priced and in short supply both coal and oil will benefit from its regulation.

In the gas producing areas where an increased supply will become available, the price will drop sufficiently to permit increasing use of natural gas for pressure maintance and repressuring oil wells. It will also make gas lift operations cheaper and will permit further recycling of marginal oil properties. The effect on the Crude Oil Industry of Federal regulation of the natural gas industry is going to be that of allowing more production of oil, better prices for oil and an expanding market for oil products.

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C. State Conservation Programs

The problem of conservation of gas and oil is primarily a problem of economics. Shortly after the turn of this century it became apparent to both the general public and to the petroleum industry that the supply of gas and oil had some definite but unknown limit. It was this acknowledgement that brought the problem out into the light. Now both the industry and the various state governments have taken clear and decisive steps along the path of conservation. The industry for its part has applied science, engineering, and ingenuity in order to find and make available to the public increasing quantities of gas and oil.[43] The various states tried to promote conservation within their own boundaries by recognizing and acting on the relationship of supply and demand. The Connally Act, passed by Congress in February of 1935, gave the necessary support to the states by prohibiting shipment in interstate commerce of petroleum produced in excess of those quantities approved by the state commissions.[44]

The state regulatory bodies have succeeded exceedingly well in their conservation programs. By keeping supply in approximate balance with demand they have prevented an excess of gas on the market and excessive above-ground storage. This in itself prevents waste. It further holds the market price of gas to a value such that producers cannot afford to flare such a valuable commodity. As has previously been pointed out, both the Federal Power Commission in its majority opinion and the Supreme Court in its minority opinion on the Phillips Case recognized the fact that such regulation and price control would seriously interfere with the state conservation regulations.

With the Federal Power Commission forced to hold gas prices to unrealistic levels it will no longer behoove the operator to save gas that might otherwise be flared. Considerable gas is produced along with oil. If there is no readily available market for this gas it may be diverted to other uses or wasted. Low prices for gas within the producing states will make cheap gas readily available and thus cause an increase and probably wasteful use. The net result of Federal regulation will perhaps be the undoing of fruitful years of state conservation.

In summary, the present trend of Federal regulation will:

1. Reduce the immediate natural gas supply available for interstate transmission.
2. Reduce, in the long run, the gas reserves of this country.
3. Tend to confine natural gas to the state producing it.
4. Increase the market and the market price of oil.
5. Increase prices of natural gas innon-producing states.
6. Decrease prices of natural gas within the producing states.
7. Cause a move of the petro-chemical industries into producing states.
8. Imperil the conservation programs of the producing states thus reducing the nation's gas reserves.

VII. FUTURE AVENUES OF LEGISLATIVE AND JUDICIAL REGULATION

Although the Supreme Court's decision in the Phillips case is causing more confusion and consternation in the oil and gas industries than has any other regulation to date, it certainly must not be considered to be the last attempt at Federal regulation. Already attempts are being made to force the Federal Power Commission to "order a freeze on all natural gas rates which now fall within its expanded jurisdiction to prevent unwarranted rate increases which are not in the public interest."[45] President Eisenhower recently remarked, "When it comes to the use of power all governments are greedy."[46] Even the Supreme Court's language in handing down its decision in the Phillips Case, "the rates charged may have a direct and substantial effect on the price paid by the ultimate consumers", warns that oil and coal may be marked for the next regulation.[47]

From time to time legislation has been introduced to Congress to reduce the present twenty-seven and one half per cent depletion allowance on gas and oil properties. The most recent attempt was a bill introduced by Senator John J. Williams (R, Del.), a member of the Senate Finance Committee, which would give a fifteen per cent depletion allowance instead of the present allowance. The fact that it was defeated when considered along with present tax revisions, does not mean that another attempt will not be made at a later date.[47]

At present the Justice Department is investigating the Hughes Tool Company and the Reed Roller Bit Company for possible anti-trust law violations.[49] Once an investigation starts it is not necessarily limited in area or scope. The fact that these two companies control about ninety per cent of the drilling bit business is apparently reason enough for the

III. FACTORS VARYING IN IMPORTANCE AND NECESSITY BETWEEN SITUATIONS

investigation. The very fact that a business is under investigation is enough in itself to deter business enthusiasm. Benson Ford, vice president of the Ford Motor Company, when asked about the Ford Company's "longest-range plan for expansion and modernization" that they have ever undertaken said that the decision to go ahead depends upon whether "we will be free to manage our affairs today, tomorrow, and five years from now."[50] His company is also under anti-trust investigation.

The Federal Power Act gives the Federal Power Commission authority over mergers, security issues, and interlocking directorates of interstate electrical utility companies.[51] Since under the present Natural Gas Act the Commission does not have the same authority over "natural gas companies" it should require no great imagination to see that this presents a fertile ground for further regulation of the interstate gas companies.

VIII. SUGGESTED ACTION TO FORESTALL FUTURE RESTRICTIONS

A. Greater Emphasis Must be Placed upon Good Public Relations

Decisive steps should be taken to acquaint the public with the benefits that the industry has given even the non-consumer. Much more advertising could be done along the lines shown by the American Petroleum Institute in the current issues of Life and the Saturday Evening Post. This type of advertising shows the large corporations in a really favorable light. It helps a little to show the American People that they have nothing to fear from a corporation in spite of the loud uproar raised against them by selfish, short-sighted politicians. The average man on the street still thinks that the big investors on Wall Street own the corporations, and that all big business is bad. He has been led to believe this by people in public life who know better. No doubt he would not believe that his own neighbor and fifteen million others own all of the big businesses and the corporations too.

Free enterprise and free competition have been "sold down the river" by the smooth talking politicians who would replace it with government regulation and ownership. Industry, all industry, should perhaps re-acquaint the public with the fact that past, present, and future opportunities lie not in the government regulation, but in free enterprise.

Probably one of the clearest, yet most expensive lessons of government in private business, has been brought to light recently in the State of South Dakota. The state for the first time since 1917 expects to be debt free. It all started in 1916 when a political faction known as the Nonpartisan League put forth the idea that State ownership could eliminate the middleman and thus pass the benefits on to the consumer. The opposing

political faction, the Republicans, made a counter move and offered the people a state-owned rural credit agency. Between 1916 and 1924 the State owned a rural credit agency, a lignite mine, a hail insurance agency, and a cement business. The lignite mine failed, the coal mine was sold in 1934 for a mere $5,000 and the State had to put up $263,000 before it could get rid of the hail insurance business. Only the cement plant made money. The State had financed their rural credit venture on the sale of $47.5 million bonds at 5.3 per cent interest. In 1926 the debt on this venture had reached $59 millions. Referring to the rural credit agency Attorney General Sharpe said in 1932, ". . .the principal causes were political infection, catering too much to vote-getting policies and cheap, shallow, superficial statesmanship."[52]

In 1936 Millard C. Scott was named rural credits director and ordered to clean up the mess. He returned 7,000 farms to privateownership within five years, but the state retained all mineral rights on these farms in hopes of eventually offsetting part of its loss if oil is found on these farms. In addition to borrowing $11 million from the Highway Fund, Mr. Scott "leveled out" the maturing securities by issuing "Humpback Coupon Bonds" at three per cent interest. That the State of South Dakota is this year going to be debt free for the first time in thirty-eight years shows how well Mr. Scott has done his job. He now refers to it as "South Dakota's socialistic venture." Speaking of this venture Scott said:

> Apparently we, in South Dakota, had the idea we could lift ourselves by the boot straps. We believed the cure for all our economic ills was contained in government ownership. Why anyone harbors the idea that a political appointee can, or will manage a gigantic business venture better than a private citizen, trained and experienced in his own line, using his own funds and risking his own future is more than we can understand.[52]

B. Political Support Required by Producing States

Probably the first action taken by the industry should be a request for an immediate re-hearing of the Phillips Case before the Supreme Court. At the same time new legislation should be introduced into Congress to correct and clarify the actual intent of the Natural Gas Act. The tone of the Supreme Court's decision should be enough to cause the gas, oil, and coal industries to pool their strength in Congress for a common cause.

It is too much to expect that our legislative bodies are the proper custodians of the public's desired policies. Congress is not always the place in which arguments are weighed and balanced against lofty ideals of public good, ultimately to be embodied in the "law of the land." Legislatures are rather convenient gathering places where pressure groups push and logroll while jockeying for political advantage. From time to time, dominance may rest with labor, agriculture, business or industry. Legislatures have been called the voice of the people, but more often than not the only voice heard is that of the best organized people. More than once Congress has been caught up in momentary enthusiasm or under pressure from powerful groups and enacted unwise legislation. Urgent matters may be overlooked or forgotten just because no pressure group is championing them. Our government is a system of checks and balances. Perhaps in the long run it comes close to the public desire when the action of the legislative, executive, and judicial all come into the picture. In finally reaching the point of balance however, the government may take extreme swings along one avenue or another.

The judiciary is in the position of testing and interpreting the laws enacted by the legislative and the powers of the executive. The courts

may vary from, but do not run counter too long to the will of the people or the prevailing political atmosphere. In the past twenty years more and more individual rights have been surrendered for the "common good." The court finds fewer and fewer reasons to protect individual rights that have been born and fostered under our heritage of capitalism. Instead powers have been passed to the government in ever increasing numbers such that we are living next door to socialism. The Supreme Court's decision in the Phillips Case and the language used in the majority opinion certainly indicate that we have taken another step towards socialism.

IX. SUMMARY AND CONCLUSIONS

The Federal regulation of the Natural Gas Industry has grown steadily, both by legislative action and judicial interpretation, until it now threatens to completely engulf not only the Natural Gas Industry but the Oil Industry as well. Some of the steps taken in this regulation have been good, others have been extremely harmful to the general public and the Natural Gas Industry, not only of this generation but future generations as well. Some poor legislation has been enacted and good legislation has been defeated because political expediencies have demanded it and bad publicity on the part of the industry has permitted it.

The Supreme Court's decision in the Phillips Case has probably doomed either the Natural Gas Industry or the Natural Gas Act of 1938. The broad interpretation given to the Act by the Supreme Court gives rise to whole new areas of regulation. Such regulation reduces the incentive to increase our present gas reserves. Since the Gas Industry is faced with increased demand it cannot properly function without increasing gas reserves. The Gas Industry is thus faced with the decision of either getting new legislation enacted to offset the Supreme Court's decision or watching its gas reserves decrease. The public is likewise faced with the choice of a continued gas supply at reasonable prices or a smaller gas supply at higher prices, depending upon whether they choose freer competition or increased regulation for the Natural Gas Industry.

D. Quality of Instruction

The Director emphasized the role personal and technical know

BIBLIOGRAPHY

1. Russell E. Westmeyer, Economics of Transportation, New York, 1953, 92-93

2. Russell E. Westmeyer, op. cit., 94

3. Russell E. Westmeyer, op. cit., 95, as quoted from Olcott v. The Supervisors, 16 Wall 678, 694-695

4. Louis Stotz and Alexander Jamison, History of the Gas Industry, New York, 1938, 422

5. Russell E. Westmeyer, op. cit., 96-97

6. Russell E. Westmeyer, op. cit., 98-99

7. Constitution of the United States, Article I, Section 3

8. Cassius M. Clay, Regulation of Public Utilities, New York, 1932, 8-9

9. Russell E. Westmeyer, op. cit., 629-630

10. Louis Stotz and Alexander Jamison, op. cit., 79

11. Russell E. Westmeyer, op. cit., 630-631, 635

12. Russell E. Westmeyer, op. cit., 648

13. The Natural Gas Act of 1938 as amended in 1946

14. The Encyclopedia Americana, New York, 1952, Vol. 11, 83a-83b

15. Hayden W. Head, "Federal Control Can Flow Through Gas Lines," Petroleum Engineer, Vol. 25 No. 10 (September, 1953), A-38

16. Ibid., A-37

17. Ibid., as quoted from Senate Document No. 92, 70th Congress, First Session, 1936, 602

18. The Natural Gas Act of 1938 as amended in 1946

19. Hayden W. Head, op. cit., A-38

20. Ibid., A-39

21. Ibid., A-42

23. Ibid., A-42, as quoted from No. 11247, State of Wisconsin, et al, Petitioners v. Federal Power Commission, Respondent, Phillips Petroleum Company, et al, Intervenors, and consolidated cases . . . . F (2) . . .(1953)

1. Jansen, J. Anonymous, Proceedings of Correspondence, New York, 1922, pp. 45-67

2. Johnson, T. Anonymous, pp. 178-180

3. Johnson, T. Anonymous, pp. 177-180, as quoted from Chapter 9 of Correspondence, pp. 1921 pp. 45-67

4. Jones, T. Anonymous, Proceedings of the New York Academy of Sciences, New York, 1922, pp. 45-67

5. Jones, T. Anonymous, pp. 178-180

6. Jones, T. Anonymous, pp. 30-32

7. Correspondence of the United States Senate, Volume 1, Section 3

8. Jones, M. Anon, Proceedings of Church Publishers, New York, 1922, 1-9

9. Jones, T. Anonymous, pp. 177-180

10. Jones Chair and Statistical Society, pp. 178, 45

11. Johnson, T. Anonymous, pp. 177-178, 45

12. Johnson, T. Anonymous, pp. 180

13. The Journal for 1921 to Subscribers to 1922

14. The Correspondence Committee, New York, 1922, 1-9, pp. 3-5

15. Johnson, T. Anonymous, pp. 177-178, 180

16. Jones, T. 1922

17. Jones, T. Anonymous, Proceedings of the Church Publishers, New York, 1922, pp. 45-67

18. Jones, T. 1922

19. Jones, T. Anonymous, pp. 45, Three Hundred Dollars

20. The Journal for 1921 to Subscribers to 1922

21. Johnson, T. Anonymous, pp. 177-178, 180

22. Johnson, T. Anonymous, pp. 180

23. Jones, T. Anonymous, pp. 30-32

24. Johnson, T. Anonymous, pp. 178-180

25. Jones, T. Anonymous, pp. 45-67

26. Jones, T. Anonymous, pp. 178-180

24. Warren L. Baker, "Future Gas Supplies Endangered," World Oil, Vol. 138 No. 1 (January, 1954), 41

25. Al Reese, "Gas Case May Bring Public Relations Test," World Oil, Vol. 138 No. 2 (February, 1954), 64

26. The Wall Street Journal, June 8, 1954, 2

27. Emphasis supplied

28. Al. Reese, op. cit., p. 64

29. Commissioners Nelson Lee Smith and Harrington Wimberly, Natural Gas Investigation, 1948, (Docket No. G-580), 8

30. World Oil, Vol. 138, No. 3, 163-164

31. Ibid., 154

32. Ibid., 164

33. World Oil, Vol. 138, No. 1, (January, 1954), 46

34. World Oil, Vol. 138, No. 3, (February 15, 1954), 164

35. K. S. Adams, "Federal Control the Sugar Coated Route to Less Natural Gas at Higher Prices," a speech delivered to the Kansas City Chamber of Commerce at Kansas City, Missouri in 1951

36. World Oil, Vol. 138, No. 3, (February 15, 1954), 89-91, 120, 163

37. The Wall Street Journal, April 6, 1954, 3

38. World Oil, Vol. 138, No. 3, (February 15, 1954), 154, 164

39. Commissioners Nelson Lee Smith and Harrington Wimberly, op. cit., 436-437

40. Ralph E. David, "Natural Gas In an Expanding Economy," Proceedings of Thirty-Second Annual Meeting American Petroleum Institute, Vol. 32, (IV) (1952), 36

41. Report of the National Petroleum Council 1952, Petroleum Productive Capacity, (Washington, D. C., 1952), 4

42. The Wall Street Journal, June 15, 1954, 4

43. Petroleum Conservation, published by the American Institute of Mining and Metallurgical Engineers (Dallas, 1951), 1

44. H. B. Fell, "Excess Oil Production Causes Waste," Oil for Today and For Tomorrow, published by Interstate Oil Compact Commission (Oklahoma City, 1953), 61

15. Jones et al. "Studies on Polymerization Chemistry," Journal of Polymer Science, Vol. 12, No. 3 (1974): 201–215.

14. Chemical Engineering Progress Symposium Series, Vol. 67, No. 116 (1971): 1–10.

13. Smith, J. "Catalysis in Industrial Processes," Chemical Engineering Progress, Vol. 45, No. 2 (1949): 89–102.

12. Lee, H. et al. "Thermal Degradation of Polymers," Journal of Applied Polymer Science, Vol. 18, No. 4 (1974): 1123–1135.

11. Wang, L. "Kinetics of Free Radical Polymerization," Journal of Chemical Education, Vol. 51, No. 6 (1974): 389–392.

10. Patel, R. et al. "Modeling Batch Reactor Behavior," Chemical Engineering Science, Vol. 29, No. 5 (1974): 1201–1210.

9. Kim, S. and Park, J. "Control Strategies for Exothermic Reactions," Industrial & Engineering Chemistry Research, Vol. 13, No. 2 (1974): 145–158.

8. Brown, T. "Safety Considerations in Chemical Plant Design," Process Safety Progress, Vol. 2, No. 1 (1974): 45–52.

7. Garcia, M. et al. "Optimization of Batch Processes," Computers & Chemical Engineering, Vol. 8, No. 3 (1974): 201–210.

6. Nguyen, T. "Polymer Characterization Techniques," Analytical Chemistry, Vol. 46, No. 7 (1974): 1023–1035.

5. Davis, R. and Thompson, K. "Heat Transfer in Agitated Vessels," Chemical Engineering Science, Vol. 29, No. 4 (1974): 891–902.

4. Miller, A. "Reactor Design Principles," 3rd ed. (New York: McGraw-Hill, 1974), 412 pp.

3. Johnson, P. et al. "Kinetics of Polymerization Reactions," Journal of Polymer Science, Vol. 12, No. 3 (1974): 201–215.

2. Smith, J. "Catalysis in Industrial Processes," Chemical Engineering Progress, Vol. 45, No. 2 (1949): 89–102.

1. Brown, T. "Safety Considerations in Chemical Plant Design," Process Safety Progress, Vol. 2, No. 1 (1974): 45–52.

45. The Wall Street Journal, June 29, 1954, 16

46. The Wall Street Journal, June 9, 1954, 9, 12

47. Bartlesville Morning Examiner, June 8, 1954, 1

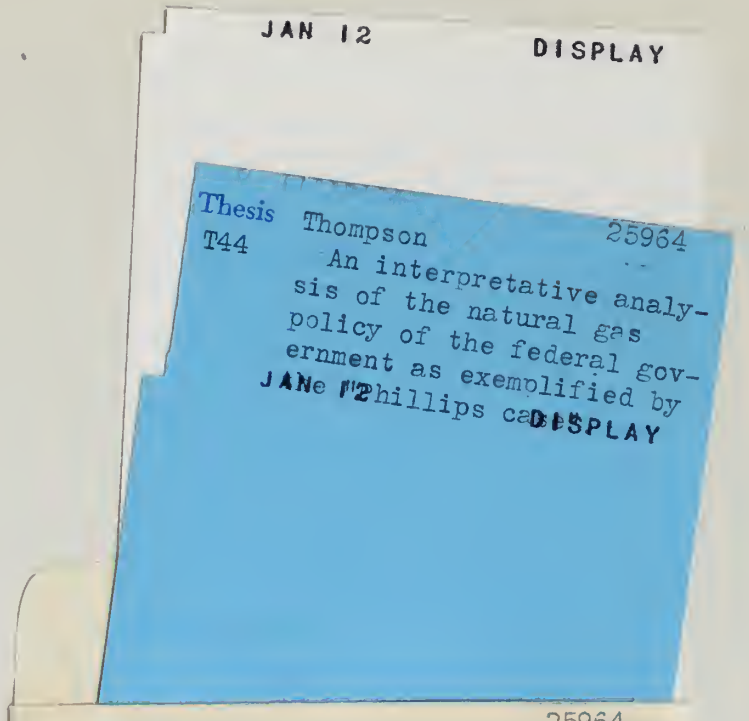
48. The New York Times, May 23, 1954, Sect. 3, F-2

49. The Wall Street Journal, June 3, 1954, 5

50. The Wall Street Journal, June 24, 1954, 11

51. The Encyclopedia Americana, op. cit., 83a

52. The New York Times, June 27, 1954, Sect. 1, 1-11



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